AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (currently amended): A fuel injection valve, comprising:

1) a valve seat member including;

a) a valve seat face for allowing a valve body to be seated thereon when the valve body is closed, ~~and~~

b) an inlet having a diameter that is slightly greater than the diameter of a flat bottom face of the valve body, the flat bottom face being positioned within the inlet when the valve body is closed,

~~b)~~ c) an injection port formed on a downstream side of the valve seat face via the inlet; and

2) a nozzle plate connected to the valve seat member and disposed on a downstream side of the injection port, the nozzle plate being formed with a plurality of nozzle holes, the nozzle holes being defined radially outwardly with respect to the injection port, a fuel passage having a cross section substantially perpendicular to an axis of the injection port, the cross section of the fuel passage having a diameter which is substantially gradually increased, the fuel passage being defined in such a manner as to connect the injection port of the valve seat member to the nozzle holes of the nozzle plate.

2. (currently amended): The fuel injection valve as claimed in claim 1, wherein

the fuel passage is so formed in the valve seat member ~~as to be~~ is shaped substantially as ~~into~~ a cone having a diameter which is substantially gradually and continuously increased ~~toward~~away from an outlet of the injection port and toward the nozzle plate.

3. (original): The fuel injection valve as claimed in claim 2, wherein

the fuel passage is so formed in the valve seat member as to be shaped substantially into a frustum of the cone.

4. (withdrawn): The fuel injection valve as claimed in claim 1, wherein

the fuel passage is formed by tapering, such that a section is so formed as to have a diameter which is substantially gradually increased from substantially a center section of the nozzle plate to the nozzle holes which are defined radially outwardly with respect to the center section, the center section of the nozzle plate being opposed to the injection port.

5. (withdrawn): The fuel injection valve as claimed in claim 1, wherein

the fuel passage is formed by curving, such that a section is so formed as to have a diameter which is substantially gradually increased from substantially a center section of the nozzle plate to the nozzle holes which are defined radially outwardly with respect to the center section, the center section of the nozzle plate being opposed to the injection port.

6. (currently amended): The fuel injection valve as claimed in claim 3, wherein

a fuel outflowing from the injection port is conveyed to the frustum of the cone of the fuel passage, converting a direction of a fuel flow from axially downwardly to radially outwardly,

the ~~cross section~~ area of the fuel passage from the outlet of the injection port to the nozzle holes is expressed with regard to ~~as a~~inlet and outlet cylindrical areas, ~~cross section of a cylinder~~ which ~~is~~are defined substantially around a center axis of the injection port,

a following expression 1 is obtained:

expression 1: $Si = 2\pi \cdot Ri \cdot Hi$

where

Si is an inlet ~~cross section~~ area,

Ri is a radius of the injection port, and

Hi is a height from the upper face of the nozzle plate to the injection port,

a following expression 2 is obtained:

expression 2: $So = 2\pi \cdot Ro \cdot Ho$

where

So is an outlet ~~cross section~~ area on the nozzle holes,

Ro is a radius ~~in this position~~ from the center axis of the injection port to the radial positions of the nozzle holes, and

Ho is a height from the upper face of nozzle plate to a ceiling of the outlet,

wherein ~~forming a~~the ceiling is shaped substantially into a taper from an inlet to the outlet ~~makes~~ so that the radius Ro is greater than the radius Ri and the height Ho is smaller than

the height Hi, ~~and~~which allows a height H to become smaller in accordance with an increase in the radius R from the inlet to the outlet, thereby controlling an increase in the ~~cross section~~area of the fuel passage covering the above region,

wherein setting up an angle of a taper of said ceiling such that the outlet ~~cross section~~area So = the inlet ~~cross section~~ area Si, and thereby Hi/Ho = Ro/Ri, makes the ~~cross section~~ area of the fuel passage substantially constant from the inlet to the outlet,

wherein ~~while~~ setting up a greater angle of the taper such that the inlet ~~cross section~~ area Si > the outlet cross section So, and thereby Hi/Ho > Ro/Ri, decreases the ~~cross section~~area of the fuel passage at a constant rate from the inlet to the outlet, and

wherein setting a total ~~cross section~~ area Sn, which is ~~cross sections~~ areas of the plurality of the nozzle holes, smaller than or equal to the outlet cross section So substantially ~~monotonously~~uniformly decreases the cross section of the fuel passage from the inlet to the nozzle holes.

7. (withdrawn): The fuel injection valve as claimed in claim 4, wherein

from an inlet to the nozzle holes of the fuel injection valve, the cross section of the fuel passage is formed substantially constant or substantially gradually decreased, with this, a fuel speed in the fuel passage is made constant or increased, thereby accelerating at least one of an atomization and a vaporization of a fuel, and

from the injection port of the valve seat member to the nozzle holes by way of the fuel passage of the fuel injection valve, the cross section of the fuel passage is decreased substantially

monotonously, with this, the fuel speed of the fuel injected from the nozzle holes by way of the fuel passage is made constant or increased, thereby further accelerating the at least one of the atomization and the vaporization of the fuel.

8. (withdrawn): The fuel injection valve as claimed in claim 5, wherein

from an inlet to the nozzle holes of the fuel injection valve, the cross section of the fuel passage is formed substantially constant or substantially gradually decreased, with this, a fuel speed in the fuel passage is made constant or increased, thereby accelerating at least one of an atomization and a vaporization of a fuel, and

from the injection port of the valve seat member to the nozzle holes by way of the fuel passage of the fuel injection valve, the cross section of the fuel passage is decreased substantially monotonously, with this, the fuel speed of the fuel injected from the nozzle holes by way of the fuel passage is made constant or increased, thereby further accelerating the at least one of the atomization and the vaporization of the fuel.

9. (new): A fuel injection valve, comprising:

a valve body including a flat bottom face;

a valve seat member including a valve seat face for allowing the valve body to be seated thereon when the valve body is closed, an inlet having a having a diameter that is slightly greater than the diameter of the flat bottom face, wherein said flat bottom face is positioned within said

inlet when said fuel injection valve is in a closed state, and an injection port formed on a downstream side of the valve seat face; and

a nozzle plate connected to the valve seat member and disposed on a downstream side of the injection port, the nozzle plate being formed with a plurality of nozzle holes, the nozzle holes being defined radially outwardly with respect to the injection port, a fuel passage having a cross section substantially perpendicular to an axis of the injection port, the cross section of the fuel passage having a diameter which is substantially gradually increased, the fuel passage being defined in such a manner as to connect the injection port of the valve seat member to the nozzle holes of the nozzle plate.

10. (new): A fuel injection valve, comprising:

a valve seat member including: a valve seat face for allowing a valve body to be seated thereon when the valve body is closed; and an injection port formed on a downstream side of the valve seat face; and

a nozzle plate connected to the valve seat member and disposed on a downstream side of the injection port, the nozzle plate being formed with a plurality of nozzle holes, the nozzle holes being defined radially outwardly with respect to the injection port, a fuel passage having a cross section substantially perpendicular to an axis of the injection port, the cross section of the fuel passage having a diameter which is substantially gradually increased, the fuel passage being defined in such a matter as to connect the injection port of the valve seat member to the nozzle holes of the nozzle plate, wherein the fuel passage is formed in the valve seat member and is

shaped substantially as a cone having a diameter which is substantially gradually and continuously increased away from an outlet of the injection port and toward the nozzle plate, wherein the fuel passage is so formed in the valve seat member as to be shaped substantially into a frustum of the cone, wherein a fuel outflowing from the injection port is conveyed to the frustum of the cone of the fuel passage, converting a direction of a fuel flow from axially downwardly to radially outwardly, the area of the fuel passage from the outlet of the injection port to the nozzle holes is expressed with regard to inlet and outlet cylindrical areas, which are defined substantially around a center axis of the injection port, a following expression 1 is obtained:

expression 1: $\mathrm{Si} = 2\pi \cdot \mathrm{Ri} \cdot \mathrm{Hi}$

where Si is an inlet area, Ri is a radius of the injection port, and Hi is a height from the upper face of the nozzle plate to the injection port, a following expression 2 is obtained:

expression 2: $\mathrm{So} = 2\pi \cdot \mathrm{Ro} \cdot \mathrm{Ho}$

where So is an outlet area on the nozzle holes, Ro is a radius from the center axis of the injection port to the radial positions of the nozzle holes, and Ho is a height from the upper face of the nozzle plate to a ceiling of the outlet, wherein the ceiling is shaped substantially into a taper from an inlet to the outlet so that the radius Ro is greater than the radius Ri and the height Ho is smaller than the height Hi, which allows a height H to become smaller in accordance with an increase in the radius R from the inlet to the outlet, thereby controlling an increase in the area of the fuel passage covering the above region, wherein setting up an angle of a taper of the ceiling such that the outlet area So = inlet area Si, and thereby Hi/Ho = Ro/Ri, makes the area of the fuel

passage substantially constant from the inlet to the outlet, wherein setting up a greater angle of the taper such that the inlet area Si > the outlet area So, and thereby Hi/Ho > Ro/Ri, decreases the area of the fuel passage at a constant rate from the inlet to the outlet, and wherein setting a total area Sn, which is areas of the plurality of the nozzle holes, smaller than or equal to the outlet cross section So substantially uniformly decreases the cross section of the fuel passage from the inlet to the nozzle holes.